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May 10, 2013
Project No. 8128.01.08

Mr. Dana Bayuk
Oregon Department of Environmental Quality
2020 SW 4th Avenue
Portland, Oregon 97201-4987

Re: Central Facilities Building Remedial Investigation Data Gap Work Plan
Siltronic Corporation
7200 NW Front Avenue, Portland, OR
ECSI #183

Dear Dana:

On behalf of Siltronic Corporation (Siltronic), Maul Foster & Alongi, Inc. (MFA) has prepared this work plan in response to a requirement from the Oregon Department of Environmental Quality (DEQ) to assess the nature and extent of trichloroethene (TCE) and its degradation products (specifically, *cis*-1,2-Dichloroethene [DCE], *trans*-1,2-DCE, 1,1-DCE, and vinyl chloride), collectively referred to as chlorinated volatile organic compounds (cVOCs), in the area of the Central Facilities Building (CFB). This work is being completed consistent with the requirements of the *Order Requiring Remedial Investigation (RI) and Source Control Measures* (the Order), DEQ No. VC-NWR-03-16, issued to Siltronic Corporation (Siltronic) on February 9, 2004.

BACKGROUND

During the July 12, 2012 meeting with Siltronic and its representatives, DEQ stated that the nature and extent of cVOCs in the supplemental source area represents a data gap that must be investigated to update the Remedial Investigation (RI) report. DEQ further described this requirement in an email to Siltronic on November 29, 2012 stating that "the area upgradient (southwest) of the Former UST System with TCE concentrations exceeding 11,000 ug/L was much larger than previously thought, and included a new unidentified source of contamination."

Specifically, DEQ noted that because the 2007 RI Report focused on cVOCs in the alluvial water-bearing zones (AWBZ), the full extent of cVOCs has not been adequately delineated in the fill zone, so that additional sampling would be required. In a subsequent February 19, 2013 meeting to discuss the scope of the investigation, DEQ directed Siltronic to evaluate the complete lateral and vertical extent (i.e., not restricted to the Fill WBZ) of cVOCs in the vicinity of the CFB.

This document describes the existing data set, particularly data collected during the supplemental injection and monitoring activities conducted between 2010 and 2012, and provides MFA's recommended approach for closing the data gaps.

EXISTING DATA REVIEW

Multiple investigations have been completed in the vicinity of the source area, including:

- Direct-push sampling of soil and groundwater by LimnoTech, Inc (LTI) in 2002 (GP02-01 and GP02-02)
- Direct-push sampling of soil and groundwater by MFA in 2003 (GP8-GP10)
- Reconnaissance soil and groundwater sampling of WS-13
- Direct-push sampling of shallow groundwater in 2004 (GP12 – GP24)

Based on the results from these sampling events, MFA concluded that the former TCE underground storage tanks (USTs) and TCE processing area were the source of cVOCs, with significant impacts found in the AWBZ. Shallow groundwater samples collected upgradient of the former USTs in GP12-GP24 were either non-detect or contained very low concentrations of TCE or its degradation products.

In 2008, DEQ directed additional investigation to support the design of the *in situ* chemical reduction (ISCR) enhanced bioremediation system and source area injections performed in 2008 and 2009. Investigations performed between 2008 and 2009, identified TCE in manufactured gas plant (MGP) dense non-aqueous phase liquid (DNAPL) and groundwater greater than the injection threshold[1]. Subsequently, sampling performed in 2010 completed the delineation resulting in a work plan for a supplemental ISCR-enhanced bioremediation system in 2011[2].

During performance monitoring, samples of MGP DNAPL from a fill zone monitoring well WS43-36 (upgradient of the source area) were found to contain TCE as high as 9 percent by weight. DEQ suggested that the detection of TCE and its degradation products in fill zone groundwater and MGP DNAPL samples necessitates re-examination and modification to the conceptual site model (CSM) for the site.

DEQ thus concluded that delineation of the full nature and extent of TCE and its degradation products in the proximity of the CFB must be addressed to complete the RI. Furthermore, DEQ concluded that the TCE detections in the vicinity of the CFB likely represent a separate TCE source from the former UST system. Based on a review of records, however, no processes are known to have occurred within the CFB that would have used, stored or accumulated such solvents.

As explained below, this work plan proposed an approach to address the identified data gaps by further investigation and delineation of the nature and extent of cVOCs in vapor, soil and groundwater in the vicinity of the CFB, including beneath the structure.

DATA GAPS IDENTIFIED

Figure 1, which shows a plan view of previous groundwater sample locations, illustrates that data collected to date does not fully delineate the vertical and lateral extent of cVOCs in the vicinity of the CFB. A 1,000 µg/L threshold for cVOCs was used in addition to the injection threshold for the purpose of identifying significant TCE-related impacts and areas requiring further investigation. Figure 1 also shows proposed boring locations, to be advanced in areas near or downgradient of the CFB where previous boring have not bounded areas of higher cVOC concentrations. Accordingly, the lateral and vertical extent of cVOCs in the vicinity of the CFB will be further delineated by collecting samples of various environmental media from the following geologic units in each boring:

- Fill – soil vapor, soil, and groundwater
- Silt – soil[1]
- AWBZ – soil and groundwater

Table 1 summarizes the sampling plan for the proposed borings showing the media to be sampled, corresponding potential depths, and the sampling objective for each geologic unit. The following describes the approach for completing the work.

SAMPLING APPROACH

MFA recommends advancing eight borings in the CFB area and downgradient (as shown on Figure 1), with sample collection in the Fill WBZ, silt, and AWBZ. As discussed in the Monitoring Well Abandonment Work Plan submitted to DEQ on March 22, 2013, one boring will be advanced in the immediate vicinity of the monitoring well (standpipe) abandonment to characterize potential impacts and to collect data to support the CFB investigation discussed herein. Proposed boring locations are approximate and subject to field modification, based on accessibility and subsurface utilities. In general, borings will be advanced to the vertical depth of the field-observed impacts, which could be as deep as 100 to 120 feet bgs, to determine the vertical extent of contamination. Sampling depths and intervals will be field determined based on observation of soil lithology, PID readings and the objectives shown in Table 1. Soil and groundwater samples will be collected using methods

[1] Based on our experience, groundwater sampling is not likely feasible in the silt unit.

and equipment previously approved by DEQ, and consistent with previous investigations[2] at the site.

Public and private utility-locating services and other information sources will be used to check for underground utilities before work begins. MFA will coordinate fieldwork to locate possible on-site utilities and piping or other subsurface obstructions.

The soil borings will be advanced using a track mounted Geoprobe® direct-push drilling unit operated by Cascade Drilling of Clackamas, Oregon, with oversight provided by an MFA geologist registered in Oregon or a geologist or engineer working under the supervision of a geologist registered in Oregon. Soil borings will be continuously logged and samples will be collected during advancement of the borings using methods and equipment previously approved by DEQ and consistent with previous investigations at the site. Organic vapor levels in the soil samples will be measured in the field by the headspace vapor method utilizing a photoionization detector (PID).

Soil vapor samples will be collected between three and five feet bgs, either from the soil borings advanced using the Geoprobe® direct-push drilling unit, or a hand auger (for the shallow depths, and at the discretion of the MFA geologist).[3] A "Post Run Tubing" (PRT) system will be used to reduce problems that may occur with sampling directly through the steel rods. Building interior and outdoor ambient air samples will also be collected using 6-liter, Summa© canisters equipped with a flow-control meter for collection of the air sample over an 8-hour period.

LABORATORY ANALYSIS

Soil samples will be analyzed for volatile organic compounds (VOCs) by United States Environmental Protection Agency (USEPA) Method 8260B.

Groundwater samples will be analyzed for VOCs by EPA Method 8260, fixed gases (carbon dioxide, methane, ethane, ethene) by American Society for Testing and Material (ASTM) Method D1945, iron (total and dissolved) by inductively coupled plasma (ICP) USEPA Method 6010A, organic carbon (total and dissolved) by EPA Method 415.1, chloride and sulfate by SW9056.

Soil vapor samples, building interior and outdoor ambient air samples will be analyzed for VOCs plus naphthalene by Modified USEPA Method TO-15 Hi/Lo to achieve low reporting

[2] In particular, MFA will direct the drilling contractor to utilize conductor casing and seals in the silt unit to minimize the potential for contaminated groundwater and/or DNAPL in the Fill WBZ to migrate vertically downward into the AWBZ. Procedures and equipment for drilling and abandonment will be consistent with previous investigations and DEQ's site-specific requirements for drilling at Siltronic.

[3] Consistent with previous soil vapor sampling events at the Site described in the July 6, 2010 letter *Revised Supplement to Workplan TCE/MGP DNAPL Injection Approach* the April 5, 2011 *Supplemental Injection Program Performance Monitoring Plan.*

limits similar to the DEQ's risk-based concentrations (RBCs) for cVOCs last revised on June 7, 2012. Soil vapor samples will also be analyzed for helium by ASTM D1946 to verify that helium did not enter the sampling system. Air Toxics of Folsom, California, will provide a 6-liter, stainless steel canister (Summa© canister) for each sample. Laboratory-specific method reporting limits (MRLs) are listed in Table 2. The MRLs assume a 6-liter sample size, with the canister dilution factor not incorporated. If there are high concentrations of non-target analytes in the samples (e.g., methylene chloride, or toluene), the laboratory may dilute the sample to avoid overloading and damaging its instruments.

MFA will receive the data electronically from the laboratory, and the data will be transferred to an EQuIS© database. MFA will perform a quality assurance and quality control (QA/QC) review of the EQuIS© electronic data deliverable file received from the laboratory. The QA/QC review will include the elements of a Tier II data validation review. To document data reliability, a memorandum will be prepared summarizing evaluation procedures, the usability of the data, and deviations from specific field and/or laboratory methods.

REPORTING

After the data have been received and evaluated, MFA will discuss the results and identify next steps with DEQ. The data collected as part of this investigation will be included within the overall remedial investigation and source control documentation.

SCHEDULE

MFA is prepared to begin work immediately upon DEQ review and approval of the proposed approach, subject to availability of a Geoprobe® direct-push drilling rig.

Sincerely,

Maul Foster & Alongi, Inc.

Kerry-Cathlin Gallagher
Project Scientist

James G.D. Peale, RG
Principal Hydrogeologist

Attachments: Tables
Figure

cc: Myron Burr, Siltronic Corporation
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TABLES

Table 1
Summary of Sampling Media and Associated Depths
Siltronic Property
Portland, Oregon

Groundwater sample	Soil sample	Soil Vapor	Geologic Unit	Approximate Targeted Sampling Depth (feet bgs)	Objective/Rationale[1]	Sample selection
		x	Fill	3 to 5	Vapor migration	Boring location
x	x		Fill	15	Evaluation of CVOC conentrations at depths for construction and excavation worker scenarios	Depth, field observation, PID readings
x	x		Fill	20 to 30	cVOC concentrations at base of the fill zone	Field observation, PID readings
	x		Silt	35	Evaluate migration of CVOC via secondary porosity features in silt	Field observation, PID readings
x	x		AWBZ	50	Vertical extent of CVOC migration	Field observation, PID readings
x			AWBZ	75	Vertical extent of CVOC migration	Field observation, PID readings
x			AWBZ	100	Vertical extent of CVOC migration	Field observation, PID readings

NOTES:

[1] Selected soil and groundwater samples will be co-located to evaluate the distribution of TCE between soil and groundwater.

AWBZ - alluvial water-bearing zone

bgs - below ground surface

cVOC - chlorinated volatile organic compound

DEQ - Department of Environmental Quality

PID - photoionization detector

RBC - Risk-based concentrations

Table 2
TO-15 Method Reporting Limits
Siltronic Property
Portland, Oregon

Compound	Modified TO-15 Hi/Lo (ppbv)	Modified TO-15 Hi/Lo (µg/m^3)
Vinyl Chloride	0.010	0.026
1,1-Dichloroethene	0.010	0.040
1,1-Dichloroethane	0.020	0.081
cis-1,2-Dichloroethene	0.020	0.079
1,1,1-Trichloroethane	0.020	0.11
Benzene	0.050	0.16
1,2-Dichloroethane	0.020	0.081
Trichloroethene	0.020	0.11
Toluene	0.020	0.075
1,1,2-Trichloroethane	0.020	0.11
Tetrachloroethene	0.020	0.14
Ethyl Benzene	0.020	0.087
m,p-Xylene	0.040	0.17
o-Xylene	0.020	0.087
1,1,2,2-Tetrachloroethane	0.020	0.14
trans-1,2-Dichloroethene	0.10	0.40
Methyl tert-butyl ether	0.10	0.36
Freon 12	0.10	0.49
Freon 114	0.10	0.70
Chloromethane	0.10	0.21
1,3-Butadiene	0.10	0.22
Bromomethane	0.10	0.39
Chloroethane	0.10	0.26
Freon 11	0.10	0.56
Ethanol	0.50	0.94
Freon 113	0.10	0.77
Acetone	0.50	1.2
2-Propanol	0.50	1.2
Carbon Disulfide	0.50	1.6
3-Chloropropene	0.50	1.6
Methylene Chloride	0.20	0.69
Hexane	0.10	0.35
2-Butanone (Methyl Ethyl Ketone)	0.10	0.29
Tetrahydrofuran	0.50	1.5
Chloroform	0.10	0.49
Cyclohexane	0.10	0.34
Carbon Tetrachloride	0.10	0.63

Table 2
TO-15 Method Reporting Limits
Siltronic Property
Portland, Oregon

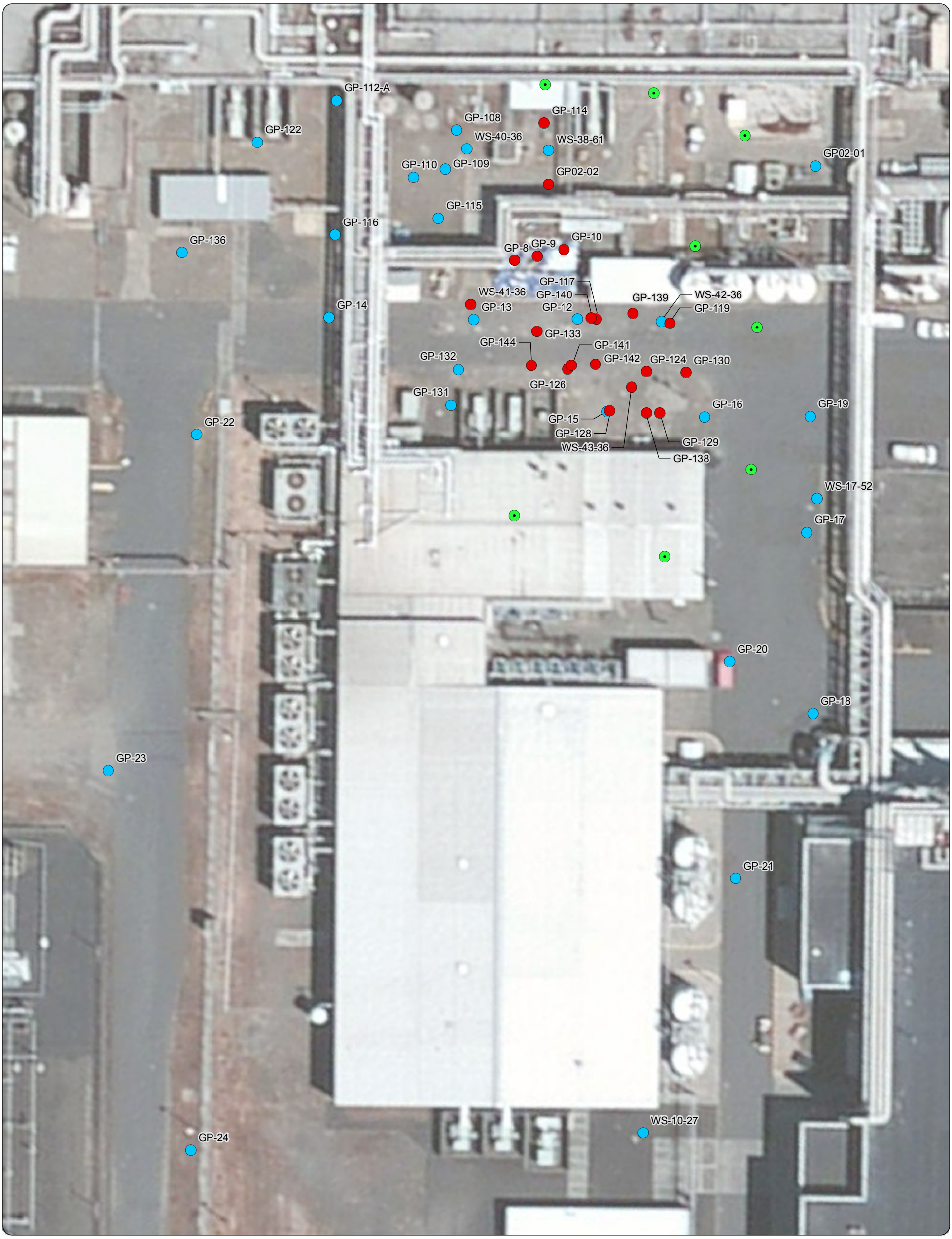
Compound	Modified TO-15 Hi/Lo (ppbv)	Modified TO-15 Hi/Lo (µg/m^3)
2,2,4-Trimethylpentane	0.50	2.3
Heptane	0.10	0.41
1,2-Dichloropropane	0.10	0.46
1,4-Dioxane	0.10	0.36
Bromodichloromethane	0.10	0.67
cis-1,3-Dichloropropene	0.10	0.45
4-Methyl-2-pentanone	0.10	0.41
trans-1,3-Dichloropropene	0.10	0.45
2-Hexanone	0.50	2.0
Dibromochloromethane	0.10	0.85
1,2-Dibromoethane (EDB)	0.10	0.77
Chlorobenzene	0.10	0.46
Styrene	0.10	0.42
Bromoform	0.10	1.0
Cumene	0.10	0.49
Propylbenzene	0.10	0.49
4-Ethyltoluene	0.10	0.49
1,3,5-Trimethylbenzene	0.10	0.49
1,2,4-Trimethylbenzene	0.10	0.49
1,3-Dichlorobenzene	0.10	0.60
1,4-Dichlorobenzene	0.10	0.60
alpha-Chlorotoluene	0.10	0.52
1,2-Dichlorobenzene	0.10	0.60
1,2,4-Trichlorobenzene	0.50	3.7
Hexachlorobutadiene	0.50	5.3
Naphthalene	0.50	2.6

NOTES:

ppbv - parts per billion by volume

µg/m^3 - micrograms per cubic meter

FIGURE



Source: Aerial photograph obtained from ESRI, Inc. ArcGIS Online/Bing Maps.

Notes:
1. Concentrations are representative of pre-injection data and do not represent current conditions.
2. µg/L = micrograms per liter
3. Proposed monitoring well locations subject to modification based on field conditions.

Legend

Proposed Boring Locations

Sample Locations

(Total cVOCs in Groundwater)

<= 1,000 µg/L

> 1,000 µg/L

Figure 1
Proposed Borings and Total cVOCs in Groundwater

Siltronic Corp.
Portland, Oregon

0 20 40
Feet

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Path: X:\8128.01 Siltronic Corp\08\19\Projects\Fig1_Proposed Borings and Total cVOCs in Groundwater.mxd
Print Date: 5/10/2013
Approved By: J. Peale
Produced By: jschane
Project: 8128.01.08